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BROOMCORN

Growing and Handling

BROOMCORN production has been shifting toward the cheaper lands of the Southwest. The leading States in the production of broomcorn at the present time are Oklahoma, Kansas, Colorado, Illinois, New Mexico, and Texas. The United States consumes and exports about 50,000 tons of brush annually. The average yields of brush are about 600 pounds per acre under favorable conditions and 200 to 300 pounds under limited moisture or other unfavorable growing conditions.

Broomcorn varieties are classed as standard, western dwarf, and whisk dwarf. At least seven distinct varieties are grown in this country.

Previous to harvest time the growing of broomcorn is very similar to that of other intertilled crops, such as corn, grain sorghums, and cotton. Planting in early June usually produces the best crop in most sections. The plants should be spaced about 3 inches apart in the row under humid conditions and 6 to 9 inches apart under semiarid conditions.

Standard broomcorn usually is harvested by breaking over or "tabling" the stalks and cutting off each brush with a knife. Dwarf broomcorn brush usually is pulled from the standing stalk. The crop should be harvested as soon as the entire brush turns green.

Threshing and baling the brush are done with special machines. Large crews of men usually are necessary for harvesting, threshing, and baling. The brush is cured either in special sheds or in ricks in the open air. The best brush is that which has a uniform bright-green color with fine, straight, smooth, nearly round fibers and which has been properly harvested, threshed, cured, and baled.

Mature broomcorn seed is nearly as valuable as oats for feed, but when the brush is harvested at the proper stage the seed is so immature as to be practically valueless.

In general the cost of growing broomcorn is about equal to the price received for the brush, but is much higher or lower in some seasons.

This bulletin supersedes Farmers' Bulletins 768, Dwarf Broom Corns, and 958, Standard Broom Corn.

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BROOMCORN GROWING AND HANDLING[1]

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BROOMCORN AND ITS USES

BROOMCORN belongs to that group of plants known as sorghums. It differs from the other sorghums in that it produces heads having long branches which form a brush. The brush is used almost exclusively for making brooms and whisk brooms.

The origin of broomcorn is not known, but it has been grown in Europe for more than 300 years. The crop appears to have been first grown in the United States by Benjamin Franklin. Broomcorn was first grown commercially in this country in the Connecticut Valley near Hadley, Mass., about 1797. From there the industry advanced westward. Successive centers of production have been the Mohawk Valley of New York, the Scioto Valley of Ohio, east-central Illinois, the Smoky and Arkansas Valleys of Kansas, the Washita Valley of Oklahoma, and the section comprising southwestern Kansas, northwestern Oklahoma, southeastern Colorado, and northeastern New Mexico. Broomcorn also was formerly grown rather extensively in Virginia, Tennessee, Missouri, Iowa, and Nebraska. In general, the westward movement of broomcorn represents a shifting to cheaper lands.

BROOMCORN PRODUCTION[2]

For many years the average annual disappearance of brush in this country for domestic manufacture and for export has been about 50,000 tons. The total consumption of broomcorn in the United

[1] This bulletin is based upon (1) records of the costs and practices in growing broomcorn obtained from 190 farmers in Illinois, Kansas, and Oklahoma in 1928 (a survey conducted by the Bureaus of Plant Industry and Agricultural Economics in cooperation with the Illinois and Kansas Agricultural Experiment Stations) and (2) experiments with broomcorn on several field stations of the U. S. Department of Agriculture in Oklahoma, Texas, New Mexico, and Kansas for the last 20 years.

[2] The average annual production of broomcorn brush in the principal producing States in the United States during the 10-year period from 1920 to 1929 was slightly less than 50,000 tons. The leading States in the production of broomcorn in 1929, with the estimated tonnage produced, were as follows: Oklahoma, 15,100; Colorado, 9,100; Kansas, 7,100; New Mexico, 6,000; Illinois, 4,500; Texas, 1,200; and Missouri, 800. Other States produced only small quantities, mostly for local broom factories.

States is not increasing. During this period the population of this country has been increasing rapidly, but the consumption of brooms has not kept pace with this growth. The increasing use of vacuum cleaners, dust mops, carpet sweepers, push brooms, and brushes and brooms made from tropical fibers has caused broomcorn brooms to be used less and less.

There is little likelihood of increasing the present consumption of broomcorn in this country. The possibility of creating a foreign market for broomcorn brush is not encouraging, because broomcorn can be grown in many parts of the civilized world when there is sufficient demand.

At the present time there are three important broomcorn-producing districts or centers. The oldest of these, often referred to as the central district, is east-central Illinois, including Coles, Douglas, Cumberland, Moultrie, Shelby, and Jasper Counties, with Mattoon as the chief marketing point. This district is in the heart of a commercial corn, small-grain, and livestock region where the soil is mostly very fertile and the annual precipitation about 38 inches. Only standard broomcorn is grown in Illinois.

Another important broomcorn center is the Washita Valley in McClain, Grady, and Garvin Counties in south-central Oklahoma. Lindsay, Okla., is the leading broomcorn market there and probably in the world. Standard broomcorn is grown in the Lindsay district, and most of it, like the Illinois crop, is of high quality. The best yield and quality of brush are obtained on the rich bottom lands, but considerable broomcorn also is grown on the uplands. The average annual precipitation is about 32 inches. Cotton also is an important crop in the Lindsay district.

Much of the broomcorn at the present time is produced in what is known as the western or dwarf broomcorn district, comprising western Oklahoma, southwestern Kansas, southeastern Colorado, and eastern New Mexico. The average annual precipitation varies from about 30 inches, in the Washita Valley of Oklahoma west of the Lindsay district, to about 15 inches in Colorado. The soil types vary widely in this district, but most of the broomcorn is grown on the lighter soils and much of it on land too sandy for successful wheat production. Some broomcorn is grown in the panhandle of Texas adjacent to the Oklahoma and New Mexico sections, but the principal broomcorn section of Texas now is in Bee County, in the southern part of the State. Broomcorn is no longer an important crop on the irrigated lands of the lower Rio Grande. Both dwarf and standard broomcorn are grown in the western district, and until recent years the dwarf greatly predominated.

For the most part the methods of growing broomcorn in the western district usually are much less intensive than in the Illinois and Lindsay districts, and the quality of the brush is poorer. Some growers in the western district are more painstaking than others and are able to produce a high quality of brush in favorable seasons.

Under favorable conditions broomcorn yields an average of about 600 pounds of brush per acre in east-central Illinois and slightly less in the Lindsay district. In the western district the average yields are only 200 to 300 pounds per acre, owing to the limited rainfall and less intensive farming methods. In the better portions of the western district high yields of brush are sometimes obtained in favorable seasons.

WHERE BROOMCORN IS ADAPTED

Broomcorn can be grown in practically every State in the Union. It will produce a fair quality of brush wherever the temperatures are high enough for corn for grain to grow well.

Broomcorn has been, or still is, grown on a commercial scale from Massachusetts and Virginia to California. It can be grown successfully anywhere in the United States except in the extreme Northern and Northwestern States, where temperatures usually are too low. It is possible to grow the crop in many localities where it is not now grown except on a small scale for local consumption. The limited demand for the crop, however, prevents it from being grown on a wide scale. Broomcorn has not been able to compete with other intensive crops on expensive irrigated land.

Broomcorn is a heat-loving plant, and the best brush is produced where the summers are rather warm and where soils are fertile and fairly well supplied with moisture. Deep alluvial soils usually produce brush of higher yield and quality than the shallower soils on the uplands, and much of the broomcorn in the past has been grown on rich river-bottom land. Poor soils and cold or extremely dry weather result in inferior brush.

VARIETIES

The varieties of broomcorn grown in the United States may be divided into three groups—standard, western dwarf, and whisk dwarf. Not less than seven distinct varieties are grown in this country, and several strains of some of these are known. It is important to know the variety and its characteristics when seed is obtained.

In addition to the varieties listed below there have been developed types of broomcorn having sweet juicy stalks like the sweet sorghums. These types are grown only on a limited scale and usually do not produce a good quality of brush.

STANDARD GROUP

Standard broomcorn usually grows to a height of from 7 to 15 feet. It bears a brush from 16 to 24 inches or more in length. The "handle" or stem of the brush is 8 inches or more in length, is strongly attached to the stalk, and is cut at harvest, being pulled only rarely. The brush usually is pushed entirely out of the boot by the lengthening of the stem at heading time.

The brush of standard broomcorn is used for making all types of brooms and whisk brooms.

At least three distinct varieties of standard broomcorn are grown in this country, viz, Evergreen, Black Spanish (Black Jap), and California Golden (Aksarben).

EVERGREEN

Evergreen is the leading variety of broomcorn in Europe and has been grown in this country for 80 years or more. There are many strains of this variety in existence, the most widely grown at the present time being Tennessee Evergreen (Tennessee Improved Evergreen), White Italian, Missouri Evergreen, and Austrian. White Italian is reported to be more uniform and of better quality than the other strains. It is a selected strain which has been grown for some years in Illinois and is now the leading sort there. The Tennessee Evergreen, Austrian, and Missouri Evergreen are practically identical. Some strains of Evergreen are distinctly taller and later than the strains mentioned, but they are not favored because the brush usually is too long and coarse for making the best brooms.

Evergreen broomcorn usually grows to a height of 8 to 15 feet. The chaff on the seeds is of a tan color. The brush of this variety is ready to harvest about 90 to 115 days after planting, depending upon the season and the date of planting. Evergreen is the most productive variety in humid sections, but it usually produces less good brush than the Black Spanish, Evergreen Dwarf, and Scarborough varieties where moisture is limited.

BLACK SPANISH

The Black Spanish (Black Jap) variety is shorter and earlier than Evergreen and has dark-brown or black chaff on the seeds. It usually grows to a height of 6 to 11 feet and is ready for harvesting 10 days earlier than the Evergreen variety. Black Spanish broomcorn has been grown in this country for more than 25 years. Its origin is not known, although similar varieties have been introduced from Europe and South America. It is now the leading variety of broomcorn in the Washita Valley of Oklahoma and is rapidly replacing the western dwarf varieties in the western district. The Black Spanish variety is favored by growers in the vicinity of Lindsay, Okla., because of its early maturity and good quality of brush. It has a tendency to produce a finer, straighter brush than the Evergreen variety and is said to be somewhat less subject to reddening, consequently bringing a higher price on the market. Black Spanish is usually outyielded by Evergreen (standard) or the western dwarf varieties except under extremely dry or frosty conditions, when its earlier maturity enables it better to escape drought and frost. Its popularity in Oklahoma and other sections of the West is due primarily to quality rather than to yield. In Illinois, Black Spanish is used chiefly for late planting when strains of Evergreen probably would not mature before frost.

CALIFORNIA GOLDEN

California Golden (Aksarben) broomcorn is similar to Black Spanish in height and time of maturity but differs from that variety in having light tan or golden-colored chaff on the seeds. This variety has been known in the United States for about 50 years but is grown rather sparingly now. Its origin is not known, but it appears to be similar to the descriptions of the broomcorn known as York, Mohawk, or Shaker, which was grown formerly in New York. In yield and quality of brush the California Golden has no advantage over Black Spanish.

WESTERN DWARF GROUP

Western dwarf broomcorn usually attains a height of from 4 to 7 feet. It bears a brush from 15 to 24 inches in length which is weakly attached to the stalk and can be "pulled" or "jerked" at harvest time without cutting. The brush is cut occasionally. The weak attachment of the brush to the stalk is caused by the slender and tender character of the lower end of the stem, which is usually only 8 inches or less in length. About one-half or two-thirds of the length of the brush is covered by the boot or upper leaf sheath at harvest. Water and insects often collect within the boots of dwarf varieties and produce a reddening of the brush which is undesirable from the market standpoint.

The chaff on the seeds is sometimes tan but is usually mostly dark red at maturity.

The brush of western dwarf broomcorn is used for making all types of brooms and whisk brooms. This type of broomcorn is grown in the semiarid western district including southern Texas.

Only three distinct varieties of western dwarf broomcorn are grown. These are Evergreen Dwarf (Oklahoma Dwarf, Acme), Scarborough, and Black Spanish Dwarf.

EVERGREEN DWARF

Evergreen Dwarf has been grown in the Southwestern States for at least 50 years, but its origin is still unknown. Oklahoma Dwarf is merely another name for this variety. Acme is a strain practically identical in yield and appearance with the typical Evergreen Dwarf. It was originated by the United States

Department of Agriculture by selection from a mixed lot of broomcorn grown at Channing, Tex., in 1906 and was distributed about 1915. The Acme broomcorn, therefore, is merely a pure uniform lot of Evergreen Dwarf. A field of Acme broomcorn is shown in Figure 1.

The Evergreen Dwarf variety usually attains a height of 4 to 7 feet and matures in about the same period as the standard Evergreen or slightly earlier. The brush is nearly as long as that of standard Evergreen when grown under the same conditions and is frequently longer than that of the Black Spanish variety. The chaff on the seeds is mostly red at maturity. The brush is equal in quality to standard brush when properly harvested and cured if it is not discolored before harvest and has not been stunted by drought.

Evergreen Dwarf was the leading variety of broomcorn in the western district until recently. It usually outyields the standard Evergreen under conditions of limited moisture.

FIGURE 1.—A field of Acme broomcorn

SCARBOROUGH

Scarborough broomcorn was originated in Texas County, Okla., in 1910, by a farmer named Scarborough, who selected a promising plant in his broomcorn field. It is now extensively grown throughout the western broomcorn district, where it has largely replaced Evergreen Dwarf. Much of the Scarborough now grown is mixed with Evergreen Dwarf. The Scarborough variety is later, slightly taller, and has somewhat longer brush and less reddened chaff on the seeds than Evergreen Dwarf. It differs from other varieties chiefly in bearing fewer seeds, with most of the seeds borne near the tip of the brush, where they are easily removed in threshing. The many fine seed branches near the tip make the Scarborough brush valuable for the hurl or outside of brooms. This class of brush usually is in good demand.

A comparison of the brush of Evergreen Dwarf (Acme) and Scarborough broomcorn is shown in Figure 2.

BLACK SPANISH DWARF

The Black Spanish Dwarf variety was originated by H. Z. O'Hair, of the Grand Prairie Seed Farm, Bushton, Ill. It is a selection from a cross between Black Spanish and Scarborough and was distributed about 1927. Black Spanish Dwarf is similar to the early standard variety, Black Spanish, in time of maturity, color of chaff, and type of brush, but has the height of stalk and weak stem attachment of the Scarborough parent.

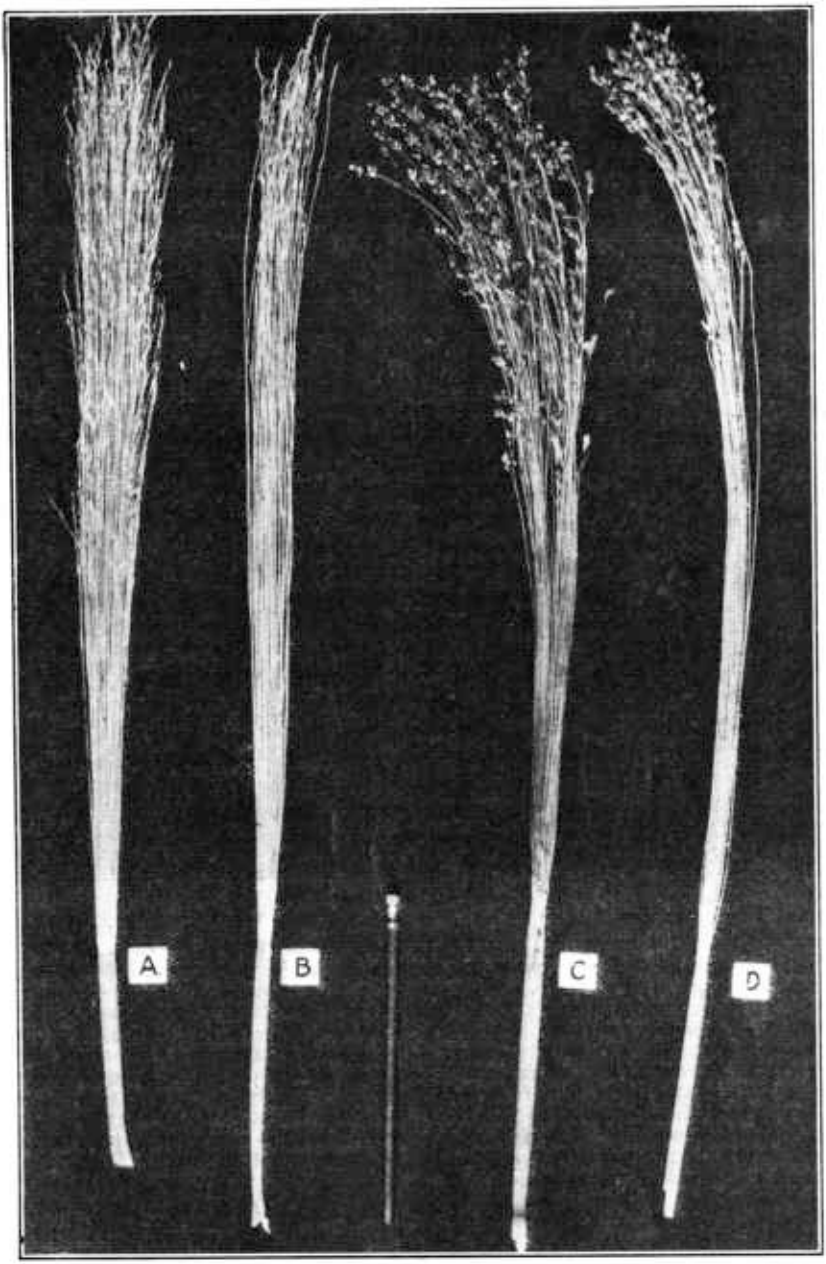

FIGURE 2.—Threshed and unthreshed heads of Acme and Scarborough broomcorn, showing that the seed branches occur nearer the tip of the panicles in Scarborough than in Acme. A and C, Acme; B and D, Scarborough

WHISK DWARF TYPE

Whisk dwarf broomcorn usually grows to a height of 2½ to 4 feet and produces a fine slender brush about 12 to 18 inches in length. The stem is easily detached from the stalk because of several creases or constrictions near the bottom where it joins the stalk. Whisk dwarf broom corn is harvested by pulling or jerking. The stem is short, and three-fourths or more of the length of the brush is covered by the boot.

Whisk dwarf brush is used for making whisk brooms and occasionally for the insides of floor brooms.

JAPANESE DWARF

Only one variety of the whisk dwarf type of broom corn is grown in this country. It is known as Japanese or "Jap" Dwarf, Sterling Dwarf, and Whisk Dwarf. It has been known for more than 70 years but has never been grown extensively, and now its cultivation has been almost discontinued. Its origin is not known, and samples of it have not been obtained from Europe. Japanese Dwarf matures about 10 days earlier than the Evergreen variety and is about as early as Black Spanish. The chaff on the seeds is usually dark red.

The Japanese Dwarf variety produces short, fine brush, well suited for making small whisk brooms, but it yields less and the brush is reddened more frequently than that of other types of broomcorn. Most of the whisk brooms are now made from the brush of other varieties.

SOURCE OF SEED SUPPLY

Broomcorn seed is obtained from three common sources—seed dealers, neighbors, and the home farm. Most of the seed is obtained from dealers, some of whom are also broomcorn-seed growers. Less than a dozen seed growers in Illinois supply practically all of the seed that is sown in that State and in the Lindsay district of Oklahoma. These growers also supply dealers and growers in many other sections. There are a few seed growers in the western district. The regular broomcorn-seed growers usually supply high-grade seed. Particular attention is paid to keeping the crop pure and free from smut.

When grown for seed, the broomcorn is left in the field until the seed is mature and then harvested in the regular manner. The brush is cured in the shed with the seed on. When sufficiently dry, the crop is threshed and the brush baled and saved for market. Such brush, of course, is overripe and reddened and usually sells for about half the price of brush harvested at the proper time. Mature broomcorn except the Scarborough variety usually yields about 3 to 5 bushels of seed per 100 pounds of brush. When the brush yield is 600 pounds per acre, 18 to 30 bushels of seed may be expected if the crop is allowed to mature. An acre of broomcorn yielding 25 bushels of seed will produce enough for planting 500 acres at the rate of 20 acres per bushel. It is thus possible for a comparatively few growers to supply all the demand for broomcorn seed in this country.

In the western district less attention usually is devoted to securing a high quality of seed. Some of the growers use seed supplied by regular seed growers in Illinois or Oklahoma, but many others obtain seed from a neighbor or from their own seed piles. Much of the seed sold by neighbors is simply taken from the seed piles left after threshing the brush. In the western district where the brush is threshed after curing, harvesting frequently is not completed until the seed is practi-

cally mature. Only part of the seed thus obtained is immature. By recleaning the seed with a fanning mill most of the light immature seeds are blown out and the heavier seed is of fair quality for planting. Seed from this source may not always germinate very well and is more likely to be mixed with hybrids of other sorghums and to be contaminated with smut than seed obtained from the regular seed growers. Frequently the grower who saves seed in the above manner is one who had obtained his seed from a regular grower the previous year.

Some growers use seed obtained from the crooked brush left in the field at harvest time. The "crooks" are not considered worth harvesting for brush, so they are left on the stalks. By leaving the crooked brush until the seed is mature a supply of seed which germinates well can be obtained. Some objection has been raised to this method of obtaining seed in the belief that the resulting crop will contain a high percentage of crooked brush. If the original seed was of a pure lot and the crooked brush is the result of environment rather than of being inherent in the variety, the seed from the crooks is just as good as that from other sources. Nevertheless, the regular practice of saving seed from crooks is not recommended.

Unless the crop from which the seed is obtained is known to be free from smut, the seed always should be treated before planting. A complete discussion of the methods of seed treatment is given later under "Diseases."

CROP ROTATIONS

Broomcorn occupies about the same position in the rotation as other tilled crops, such as corn, cotton, and grain sorghum, which follow small grain or a sod crop whenever possible. Frequently broomcorn is grown directly after other tilled crops, including broomcorn itself. In the Lindsay district of Oklahoma, where cotton is the predominating crop, broomcorn usually is grown alternately with cotton, but often follows another crop of broomcorn, or corn, wheat, or oats.

In the western district broomcorn usually follows broomcorn, grain sorghums, or corn. Occasionally it is planted on land that has produced winter wheat the previous season, and when winter wheat is destroyed by winterkilling or soil blowing the wheatland is listed or disked in the spring and seeded to grain sorghums and broomcorn.

In Illinois broomcorn usually is grown in the rotation following corn, wheat, or oats, except where it follows broomcorn. Winter wheat occasionally winterkills, and when this occurs part of the land may be planted to broomcorn in the spring.

Sorghums usually exert a somewhat deleterious effect on crops immediately following them, but this is less pronounced after broomcorn than after other sorghums, partly because the crop is removed from the land earlier. Broomcorn can be followed with winter wheat more readily than can corn or cotton, because the crop is removed in time to prepare the land for fall seeding.

METHOD OF GROWING

Previous to harvest time the growing of broomcorn is very similar to that of other tilled crops, such as corn, grain sorghums, and cotton. The soil preparation, planting, and cultivation all are much the same for those crops in any locality, with a few exceptions. Broomcorn is harvested earlier and often does not need as many cultivations as corn and cotton. It usually does not require any thinning or as

much hoeing as cotton needs, but replanting is more frequent than with corn or cotton.

Beginning with harvest the methods employed and the labor and expenses required for broomcorn differ widely from those of other crops.

SEED-BED PREPARATION

The land on which broomcorn is to be planted often is not worked until some time in the spring, although fall plowing frequently is practiced. In the Washita Valley of Oklahoma the land for broomcorn usually is plowed with a horse-drawn gang or sulky plow, but some of the land is listed instead of being plowed. The plowed land is disked and harrowed in preparation for planting. The listed land is relisted or the ridges broken previous to planting.

In the western district, where grain sorghum is the leading crop, most of the land is prepared by listing in the spring. Frequently the land is disked before being listed. Disking before listing is almost necessary if stalks of sorghum, broomcorn, or corn have been left on the land or if a heavy growth of weeds has started. This disking results in a better seed bed and helps to control weeds. After listing, the ground is sometimes worked with a "ridge buster," but usually it is listed a second time. In the second listing the ridges are split, and the broomcorn usually is sown at this time with a planting device attached to the lister.

In east-central Illinois much of the land is plowed with a tractor gang plow, the 2-plow tractor being the most popular size. If broomcorn follows corn which has been husked from the standing stalks, the stalks usually are broken or disked before the land is plowed. If broomcorn follows broomcorn, the stalks are either burned, cut up, or broken down before plowing, or else they are plowed under directly. After plowing, the land is double-disked and harrowed. Much of the disking in Illinois is done with a tractor-drawn tandem disk. If the tractor has sufficient power, a harrow is attached behind the disk, and the land is gone over only once.

PLANTING

Broomcorn may be planted with any corn or cotton planter or with a lister planter by using special broomcorn or sorghum plates. Broomcorn plates can be purchased or can be made by boring holes three-sixteenths or one-fourth of an inch in diameter in blank plates. All of the planting in Illinois and part of that in other sections is done with the 2-row corn planter. In the western district a 2-row or 1-row lister planter usually is used for planting broomcorn.

DATES OF PLANTING

Broomcorn is planted at any time between April 1 and July 1, but mostly between May 1 and June 15. Most of the planting is done in April in the Lindsay district, in May in Illinois, and in June in Kansas. The earlier the crop is sown the earlier it will be ready for harvest, but since the early-sown crop requires a longer period to reach maturity, the difference between the harvest periods will be much less than that between the planting periods. Sieglinger in his broomcorn experiments at the United States Dry-Land Field Station at Woodward, Okla., has shown that broomcorn planted about June 15 produces more and better brush than that planted earlier. Similar experiments made by the New Mexico Agricultural Experiment

Station at the United States Dry-Land Field Station at Tucumcari, N. Mex., show that June 15 is a good time to plant there also. Broomcorn planted about June 1 frequently has been caught by a drought during the critical period for brush development. Planting about May 15 also has produced better brush at Tucumcari than planting about June 1. Experiments at other stations in the western district favor the planting of broomcorn in June.

The experience of farmers also has shown that broomcorn makes the best and most rapid growth from comparatively late seeding, after the soil has warmed up well.

Many growers sow at least a part of their broomcorn earlier than is desirable for the best development of the crop in order to be able to complete the harvesting while labor is more abundant and cheaper than after cotton picking or corn husking begins. The sowing of broomcorn at different dates makes possible the obtaining of labor for harvest at the proper time. If all broomcorn reached maturity at approximately the same time, the labor supply in a locality might be insufficient to complete harvesting within the required time. It also would be difficult to obtain transient labor for such a short period. Many growers make two or three plantings of broomcorn in order to avoid having the entire crop reach maturity at the same time. If there is an interval of 10 days or more between the harvest of different lots of broomcorn on the same farm it is possible to cure the two crops in the same shed, thus doubling the capacity of the shed. Where the labor supply at harvest time is sufficient, planting from about June 1 to June 15 or 20 is advisable, at least in the western districts.

Early planting frequently results in an unsatisfactory stand, and the crop must be replanted. Some growers, knowing that good brush will be produced only from a good stand, replant twice if necessary.

The lister planter drops the seed at the bottom of a furrow, where the soil usually is much colder than nearer the surface. This cold soil hinders germination and frequently prevents a good stand. Heavy dashing rains shortly after seeding often injure the stand of broomcorn planted in lister furrows by washing dirt into the furrows. Water running down the furrows also will wash out the seeds on the steep slopes and bury them too deep in soil at the bottom of the slopes. The failure to get stands and the retarded growth of broomcorn sown in lister furrows make the yields from this method lower than from broomcorn planted with a corn planter on plowed ("flat broke") land, but the lister method is more economical of labor.

RATE OF PLANTING

The rate of planting is of extreme importance in securing a good quality of broomcorn. If the stand is too thick, the brush will be short and "spiky," and if too thin it will be too long, coarse, and crooked. The stand should be uniform, and good clean seed will aid in securing uniformity.

In the humid broomcorn sections, comprising east-central Illinois and the Lindsay district in Oklahoma, the broomcorn plants should be spaced rather thickly, a plant about every 2½ to 4 inches (usually about 3 inches) apart in the row being considered desirable. About 60 to 75 plants per rod is considered a good stand. To obtain such

a stand the seed should be planted at the rate of about 70 to 100 seeds per rod. Some growers plant more than 100 seeds per rod when planting is done early with a lister. The seed germinates best in warm soil, and late planting need not be quite so thick as early planting.

In the western district, where the moisture supply is likely to be limited, a thinner spacing is desirable. Results at the United States Dry-Land Field Station at Woodward, Okla., have shown that a spacing of 6 to 9 inches between plants (25 to 35 plants per rod) produces the highest yield and quality of brush of western dwarf broomcorn on the average. At the Tucumcari, N. Mex., station the 6-inch spacing produced more marketable brush than wider spacings. At Amarillo, Tex., a spacing of 6 to 8 inches resulted in more brush than the thicker or thinner spacings. Standard broomcorn suckers less and should be planted slightly thicker than the western dwarf varieties. To obtain a stand of standard broomcorn in the western district, the seed is planted at the rate of about 40 to 60 seeds per rod. From 40 to 50 seeds of dwarf varieties per rod are sufficient. The quantity of seed required usually varies from 2 to 3 pounds per acre. A bushel of seed, weighing 48 pounds, will thus be sufficient for 16 to 24 acres. A few growers plant more heavily than this, especially when planting early with a lister planter; and a few growers in the drier sections plant less than 2 pounds per acre. About 24,000 to 30,000 broomcorn seeds ordinarily weigh 1 pound.

Occasionally broomcorn is planted in hills instead of drills,but this practice is becoming less frequent. Experiments at the field station at Woodward, Okla., show that the yield and quality of brush from hill and drill planting is nearly the same when the number of plants per rod is the same. Planting in hills is slower and has no advantage except perhaps in enabling better weed control.

Most broomcorn is grown in rows 3 to 4 feet apart, but some growers in the western district space the rows double the usual distance, or 6 to 8 feet apart. Experiments at Woodward, Okla., show that the yields of brush are considerably lower from the wide spacing.

CULTIVATION

The germination of broomcorn is rather slow except in warm soil, and the plants are rather delicate and grow slowly at first. As soon as the plants are large enough, the field should be cultivated promptly in order to destroy weeds. As a rule, ample tillage before the crop is planted will save considerable later cultivation to control weeds. The number of cultivations to be given broomcorn depends upon the amount of weed growth. Under humid conditions three to five cultivations are usually sufficient, and in the drier western districts the crop is usually cultivated only two or three times. The tillage implements are the same as those used for cultivating corn, cotton, and grain sorghums. In the Lindsay district the riding cultivator is commonly used for cultivating. The broomcorn field sometimes is harrowed just as the plants are coming through the ground.

The listed broomcorn is commonly worked once with a 1-row lister cultivator. This is a narrow sled equipped with disks and is locally known as a go-devil. It is followed by two or three cultivations with a 1-row, 2-horse cultivator. In the western district, where nearly all of the broomcorn is planted with a lister, it ordinarily is cultivated

twice with a 2-row lister cultivator, usually referred to as a "curler." In the first cultivation the dirt is thrown out of the furrow, and in the second it is thrown in, to bury weeds in the furrow, kill the weeds on the ridge, and level the ridges. Occasionally a single-row go-devil is used, and sometimes a homemade 2-row weeder known as a knife sled is substituted for the curler. Occasionally a harrow is also used to kill the weeds on the ridges and to bury the small weeds at the bottom of the furrow with dirt which is dragged in.

Broomcorn requires about the same number of cultivations as the grain sorghums, but owing to its being harvested earlier it frequently is cultivated somewhat less than cotton or corn.

HARVESTING

Broomcorn is harvested either by cutting or pulling, usually depending upon whether standard or dwarf broomcorn is grown.

A vast quantity of hand labor is required in harvesting and handling broomcorn. About 10 to 14 days of man labor are required to harvest, cure, thresh, and bale a ton of cured brush. A ton of cured brush contains about 40,000 to 70,000 heads, and each brush or head must be cut or pulled separately by hand. In all subsequent operations the brush is handled in small handfuls or armfuls, and care should be used to avoid tangling the fibers. The necessity of doing the work promptly requires the use of large crews. Many growers use 30 to 40 or more men for harvesting and threshing their crop.

Considerable broomcorn harvesting is done by family and exchange labor in the western district, where harvesting is often not completed promptly. Exchanging labor at harvest time also is practiced by small growers of broomcorn in other sections, and baling crews frequently are made up largely of neighboring farmers. Some growers hire their harvesting, threshing, and baling done on shares or on contract at a stated amount per ton or per acre.

Broomcorn brush turns from pale yellow to green before maturity, and it should not be harvested until the entire brush is green from the tip down to the knuckle. If harvested while the lower ends of the fibers are still yellow, they will be weak and flabby at the bottom. The seeds are about in the milk stage when the brush is ready to harvest. About four or five days after the proper harvesting stage is reached the brush begins to get overripe and starts reddening, and the seeds become firmly attached to the branches. The brush does not increase in weight after the seeds reach the milk stage, all of the later growth going into the seeds.

Broomcorn harvest begins in southern Texas in June and in Oklahoma in July. The harvesting is not completed in the western district until October. Most of the broomcorn in the United States is harvested during August and September.

HARVESTING STANDARD BROOMCORN

Standard broomcorn is nearly always cut from the stalk. Most of the crop is "tabled" or "broken" before it is cut, but some of it is harvested with a corn binder. Tabling or breaking consists in walking between two rows of broomcorn and breaking or bending the stalks diagonally across each other, forming a so-called table of the two rows, with the heads extending out beyond the rows forming the

edges of the table. The table is formed at a height of about 2½ to 3 feet. Usually the tabler walks backward, facing the table as it is formed, but sometimes he walks forward and breaks the stalks behind him. Ordinarily the harvester cuts the brush from the stalks immediately after tabling two rows across the field. (Fig. 3.) Cutting requires two or three times as long as tabling. The cutting is done with a special broomcorn knife. (Fig. 4.) The harvester grasps the brush in one hand and pulls the stem against the blade of the knife at the point on the stem where it is to be cut. (Fig. 5.) By pulling the brush against the knife blade and exerting an outward pull at the same time the brush with its handle or stem can be withdrawn without cutting entirely through the boot. The boot must be

FIGURE 3.—Field of broomcorn, partly tabled, showing the harvested heads lying in piles on the table

pulled from the stem at the time of cutting if it is cut through accidentally. As soon as a handful of brush is gathered it is thrown on the table in small bunches. These bunches, which are of convenient armfuls for loading on a wagon, are placed only on alternate tables. The table on which the brush is piled is referred to as a "lay-on," and the other on which no brush is laid is called a "lay-off."

One man can table and cut an acre of broomcorn in about 15 to 25 hours. Rapid, experienced men when paid by the acre or by the table harvest from three to four tables, or three-fifths to four-fifths of an acre, in a day. (A table in Illinois consists of two rows 80 rods long, or about one-fifth of an acre.) Inexperienced men and transient hands paid by the hour usually harvest about two-fifths of an acre per day on the average. An average day hand thus requires about seven to nine days to harvest a ton of cured brush from 4 acres. The better the yield the shorter the time required to harvest a ton of brush, as it takes only a little longer to harvest an acre of high-yield-

ing broomcorn than it does to harvest a poor crop. Considerably more time is required to harvest a crop of broomcorn containing much defective brush than a crop which is uniformly good. An efficient hand may harvest a ton of good high-yielding brush in three or four days.

FIGURE 4.—Knife used for cutting broomcorn brush from the stalk

If the crop is lodged, the labor of harvesting is practically doubled. The cost of harvesting lodged broomcorn is so high that frequently it is left unharvested, especially on farms rented for a share of the crop with the tenant paying for the harvesting.

The brush is left on the table 24 hours or less, usually being hauled soon after it is cut. In case of rain the piles are turned over on the table as soon as the tops of the piles are dry. In hauling, a wagon is driven over the lay-off table and a man on each side of the wagon loads the brush from the two adjoining lay-on tables. The brush is piled upon the wagon in two tiers with the seed ends outward. (Fig. 6.) Dump racks are used for hauling the green brush to the shed. The racks used in Illinois (fig. 7) cost about $25 each, but the simple racks used in Oklahoma with the load balanced on the rear axle of the wagon and the front end held down with a stay chain (fig. 8) cost only about $15.

FIGURE 5.—Method of cutting broomcorn

One ton of green brush is equivalent to about 500 pounds of cured brush with the seed removed. Two men and a team haul about six to nine loads of green brush per day. The brush is hauled to the front of the curing shed and slipped off to the ground in piles. (Fig. 8.) As soon as a few loads have accumulated, the brush is threshed

and placed on the slats within the shed to cure. Curing requires about 10 days to three weeks, depending upon the weather, the dryness of the brush, and the thickness of the layer placed on the slats.

In the western district much of the standard broomcorn is not

FIGURE 6.—A load of green broomcorn brush en route to the curing shed

handled in the manner described above. If the crop is less than about 9 feet high it does not form a good table, and frequently the stalks are simply broken over in the same row instead of being tabled. By this method the harvester walks forward, breaking the stalks

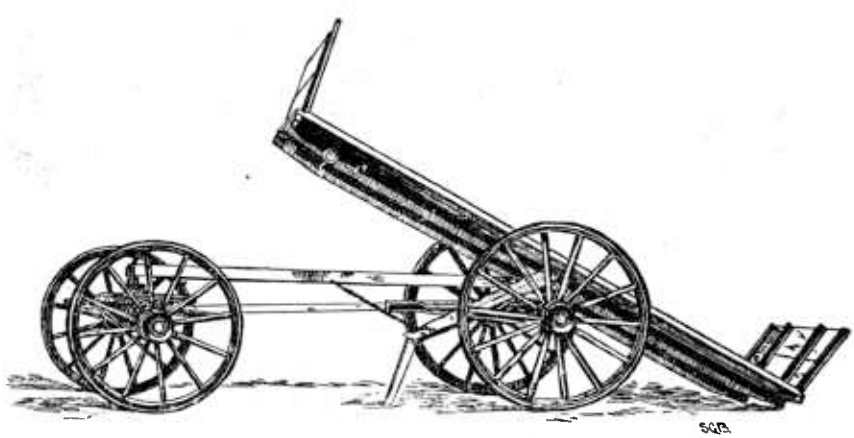

FIGURE 7.—Broomcorn dump rack used in Illinois

forward, and when the end of the row is reached he turns around and starts cutting back on the same row with the brush pointing toward him. The stalks are broken at a point which leaves the hanging brush about waist high. If the stalks are not more than 7 feet tall the brush sometimes is cut from the standing stalk without breaking.

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When the crop is not tabled the bunches of brush either are thrown on the ground or upon stalks which have been broken over, or else

FIGURE 8.—Unloading brush with the type of dump rack used in Oklahoma

they are placed between two stalks in a row (fig. 9) so as to hold the brush up off the ground. In fields yielding 300 to 400 pounds per acre

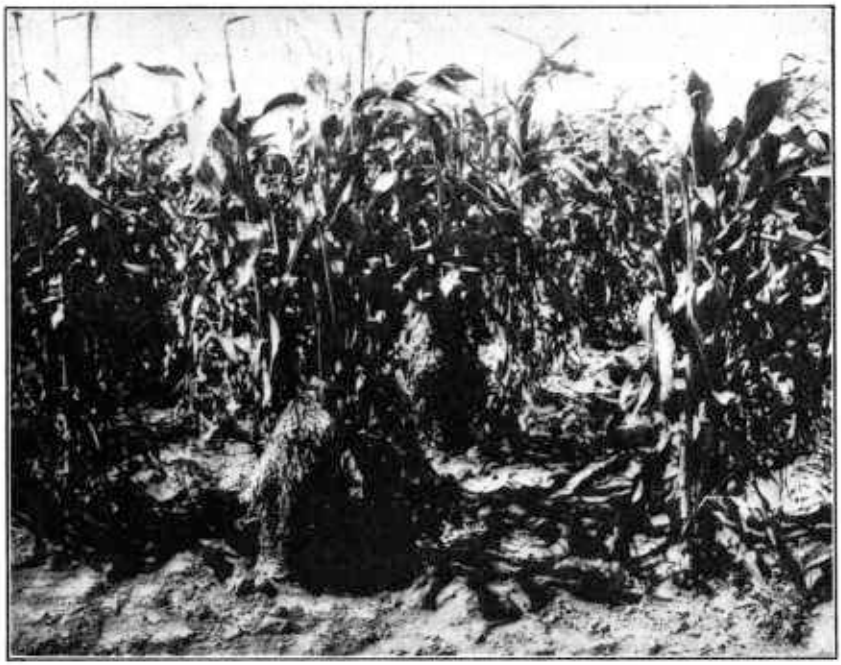

FIGURE 9.—Bunches of brush placed between dwarf broomcorn stalks to cure

an average hand can break and cut a ton of cured brush in about seven days. In the western district, where these latter methods of harvesting are practiced, the brush often remains in the field for

several days and sometimes two weeks before it is hauled. The curing is completed in ricks. Ordinary nondumping racks (fig. 10) costing about $15 are used for hauling brush to the rick. The crop is left in the ricks until entirely dry, when it is threshed and baled in one operation.

Occasionally in the western district broomcorn is cut with a row binder (corn binder) and allowed to cure in the shock. The brush is cut from the stalk later by hand. Brush harvested with a binder seldom is of the best quality because it is bleached. This method of harvesting is practiced only in emergencies, either when labor is insufficient to harvest the brush while in proper condition or in order to avoid hiring labor. By this method the stalks can be bound and shocked and the brush cut later by the farmer or members of his family, thus avoiding a heavy cash expense for harvest labor.

HARVESTING DWARF BROOMCORN

Dwarf broomcorn is pulled or jerked from the standing stalk instead of being cut. The operator grasps the top or "flag" leaf in

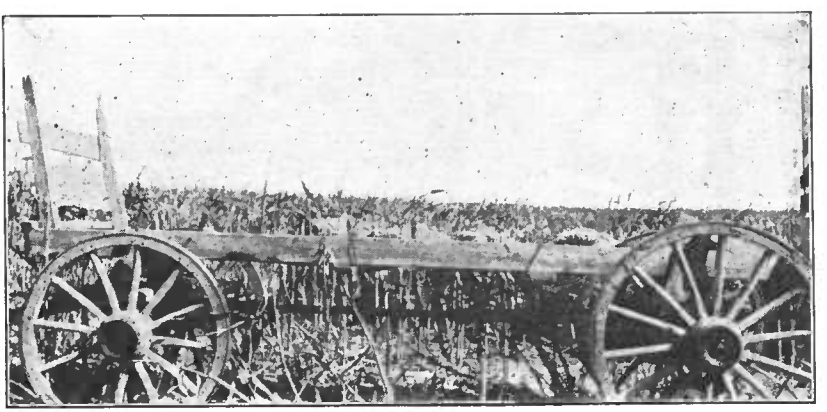

FIGURE 10.—Rack used for hauling broomcorn in Kansas

one hand and the ends of the brush in the other hand and gives a quick pull outward with both hands and a jerk upward on the brush. This snaps off the brush stem where it joins the stalk at the upper joint. As soon as a handful of brush is gathered it is thrown in a pile or is placed between stalks (fig. 9), as mentioned under the discussion of harvesting standard broomcorn. The subsequent curing and handling of the dwarf brush is identical with that of standard brush in the western broomcorn district. Many growers go through their fields of dwarf broomcorn a second and occasionally a third time to pull the brush which was immature at the time of the first harvest.

A man can pull about a bale (one-sixth of a ton) of cured brush per day in dwarf broomcorn yielding one bale per acre or thereabout. Average transient hands pull slightly less than a bale per day, but good workers frequently pull as much as 500 pounds in 10 hours in good fields. Pulling is more rapid than breaking and cutting, because no time is lost in determining where the stem should be cut and only one operation is necessary.

THRESHING

The operation of threshing broomcorn brush often is referred to as scraping or seeding. Threshing is a disagreeable task, because the fine hairs which are knocked off the chaff are very irritating to the eyes and skin. Many men refuse to work with broomcorn, because of the discomforts of "broomcorn itch."

Broomcorn may be threshed either before or after curing. It is of better quality when threshed before curing, because fewer of the fine branches are knocked off by the thresher when the brush is moist and flexible. All of the broomcorn grown in Illinois and in the Lindsay district of Oklahoma except that saved for seed is threshed before curing. In the western district most of the brush is threshed after curing and is baled immediately after threshing. All brush that is threshed before curing is cured in sheds or on racks, and some brush is shed cured before threshing.

The power threshing machines have two cylinders, one above the other, rotating in opposite directions. The brush is carried past the

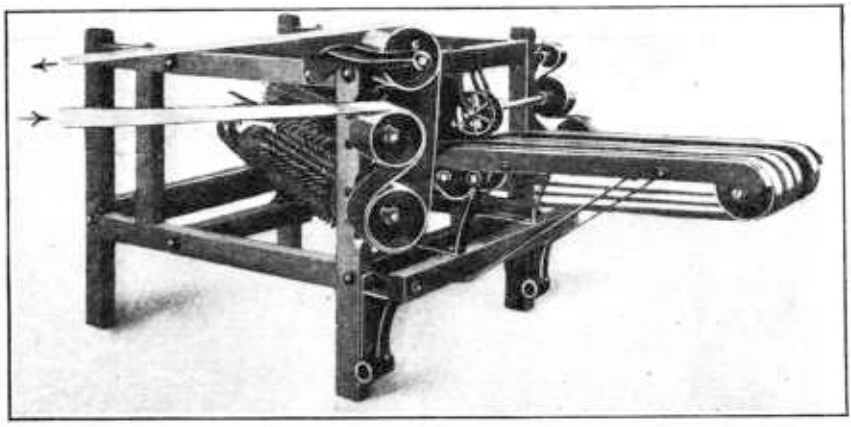

FIGURE 11.—Side view of a self-fed broomcorn thresher

cylinders by a toothed chain which runs at an angle with the cylinders. The seeds at the tip of the brush are knocked off first, but as the brush is carried toward the far ends of the cylinders the chain runs nearer the cylinders and the remaining seeds are removed.

Most of the threshing is done with large self-fed power threshers (fig. 11), but a few growers use small hand-fed machines (fig. 12). The large outfits require a crew of 15 to 30 men for the entire operation. One man looks after the thresher and engine; another feeds the brush into the machine; and from 5 to 10 men untangle the brush, even it up, slide it toward the thresher, and sort out the poor brush. The remainder of the crew carry the brush in armfuls from the pile to the table on which it is evened, or carry the brush from the thresher and place it on the shelves in the shed. The placing of the brush on the shelves is a considerable task because the slats must be put in place as the brush is brought in, and each pair of slats will hold only about one large or two small armfuls of brush. An average crew of 26 men will thresh and shed about 15 to 18 tons of cured brush per 10-hour day. Smaller crews sometimes can thresh and shed nearly as much brush as the larger crews, but they are likely to do poorer work.

It is important that practically all the seed be removed from the brush, and this can not be done unless it is evened at the butts or tips and laid straight before being fed into the thresher. The feeder chain should engage the brush just above the knuckle. Any seed to be removed should not be nearer to the chain than 4 inches. Feeding should be uniform with the brush in a layer about 2 inches thick.

The proper speed for the thresher cylinders is about 1,200 to 1,500 revolutions per minute. Slow cylinders will not thresh clean, and fast cylinders will break off too many fine branches or seed fibers.

Most of the broomcorn threshers are driven by 2-plow size tractors, which are also used to haul the machine from one farm to another. Some operators have mounted the threshers on autotrucks, and the motor of the truck furnishes the power for driving the thresher. The large threshers when new cost about $450 delivered. The most expen-

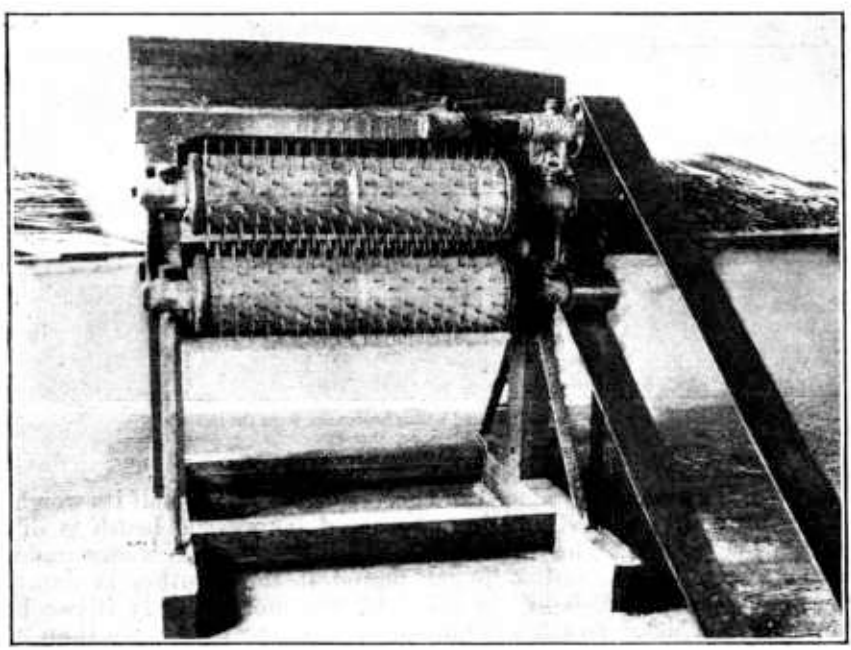

FIGURE 12.—Rear view of a hand-fed broomcorn thresher

sive item of replacement is the feeder chain, which costs about $30 or more.

The small hand-fed machines have either one or two cylinders. They can be operated by small crews of from 1 to 8 or 10 men. A small gasoline engine will furnish sufficient power for one of these threshers. Better threshing is possible with hand-fed machines than with power machines if sufficient care is taken.

The usual procedure in harvesting and threshing broomcorn is to start the entire crew to tabling and cutting brush in the field. After the first tables have been cut, from 2 to 4 teams with 2 men to each wagon are set to hauling brush. The brush is hauled and dumped in front of the shed. The custom thresher comes to the farm during the afternoon or evening, or perhaps the following morning, and the entire crew, except the haulers, is called in from the field to assist with

the threshing. The hauling continues until all or most of the harvested brush has been brought from the field and threshed. When the threshing is completed the men resume the harvesting until the thresher returns, perhaps on the following day.

Where the threshing is done from the rick a smaller crew is required for the threshing operation than where the threshed brush must be placed in the shed to cure. Rick-threshed brush is nearly always baled immediately from the thresher. (Fig. 13.) A crew of about 20 men is required for threshing and baling brush from the rick. Such a crew consists of 1 man to run the machinery, another to place the brush inside the baler, about 7 to 8 men to "butt up" the brush and feed the brush to the thresher, about 5 or 6 to carry brush from the thresher to the baler and assist in pressing and tying the bale, and about 4 men to carry brush from the ricks to the feeding table. Such a crew will thresh and bale about 8 to 10 tons of brush per day.

FIGURE 13.—Threshing and baling broomcorn from the rick

CURING

Threshed green brush placed in the shed loses about half its weight in the form of water which is evaporated before the brush is dry enough for baling. This requires from 10 days to two weeks under ordinary conditions, and a longer period if the weather is damp. The longer the brush is left in the field, the more quickly it can be cured in the shed. Brush left on the table in the field more than 24 hours, however, is likely to become bleached. The brush is usually placed on the slats at a depth of 2 to 3 inches, depending upon the amount of moisture that it contains. (Fig. 14.) If the brush is piled too thickly it may become "shelf burnt" or discolored on account of heating, together with some reddening. When the brush starts to heat it should be reshelved to prevent further damage.

Sheds are usually built in stalls or bents 7½ feet wide, 10 feet and sometimes more in height, and any convenient length. The cleats on the sides of the stalls consist of 1 by 4 inch boards spaced 2 inches apart. The slats are laid across these cleats when filling the shed with brush. The slats are 1 by 2 inch boards 8 feet long. This length permits an overlapping of 3 inches at each end of the slat. The 4-inch cleats spaced 2 inches apart permit a layer of brush every 6 inches. When the brush is piled in 3-inch layers there is an air space of 3 inches between each layer. Two slats are necessary to support each layer of brush in a tier. These slats are placed about 16 inches apart.

The outside posts of the shed usually are 6 by 6 inch timbers or round posts 6 to 9 inches in diameter and 10 feet long. In well-built sheds these posts are creosoted and set on a concrete base. The inside posts usually are of 2 by 4 inch or 2 by 6 inch pieces, long enough to reach to the rafters. The roof usually is made of corrugated iron, but shingles and prepared roofing also are used. The roof should extend 2 to 4 feet beyond the plate. The ends of the gables are boarded with sheathing, but the ends and sides of the shed below the plate usually are left open. No braces are used except on the rafters and between the posts and the plate. The cleats serve as braces for the posts. Frequently several cleats are nailed to the inside posts

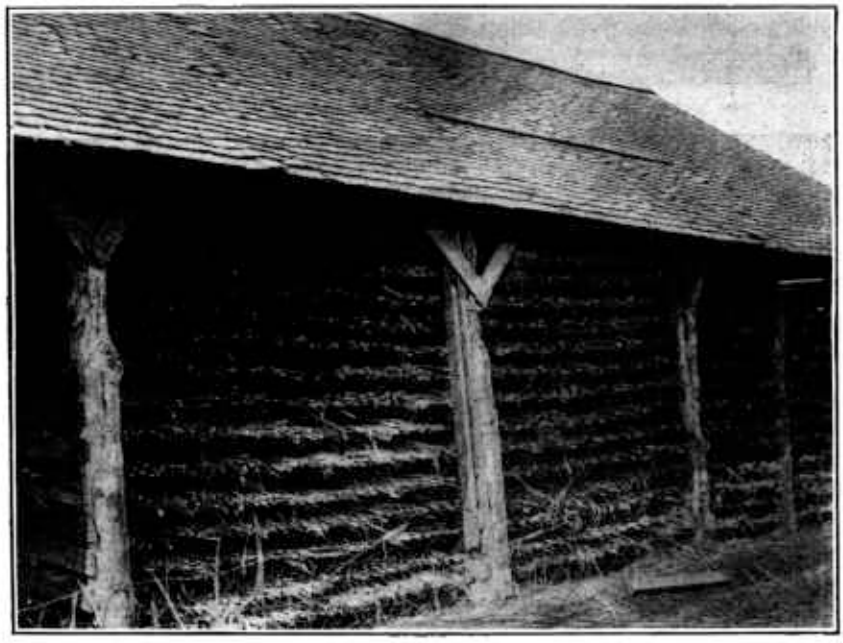

FIGURE 14.—Shed filled with brush in process of curing

above the level of the plate, to permit the use of the space next to the roof for curing brush.

Sheds are built with the stalls either crosswise (fig. 15) or lengthwise (fig. 16). Most of the sheds in Oklahoma have cross stalls 24 feet in length, but in Illinois the lengthwise stalls are more common.

A stall 7½ feet wide, 24 feet long, and 10 feet (or 20 cleats) high will hold about 1½ tons of cured brush piled 2 to 3 inches deep. Such a stall will hold about 10 tiers of brush 20 layers high and will thus require about 400 slats. At this rate about 266 slats are necessary for curing a ton of brush. The slats cost 6 to 10 cents apiece, depending upon the quality and kind of wood. The cost of building an ordinary shed is about $30 to $40 for labor and material per ton of capacity, but well-built sheds may cost up to $60 per ton of capacity. Broomcorn sheds are not commonly used much except for curing the brush and the storage of the bales for a short time before the crop is marketed. (Fig. 17.) They can be used, however, for storing machinery

FIGURE 15.—Broomcorn shed with crosswise stalls

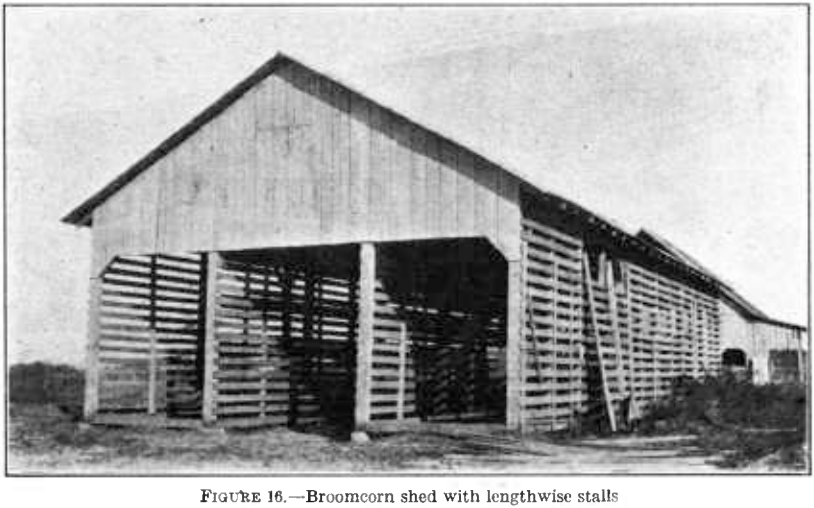

FIGURE 16.—Broomcorn shed with lengthwise stalls

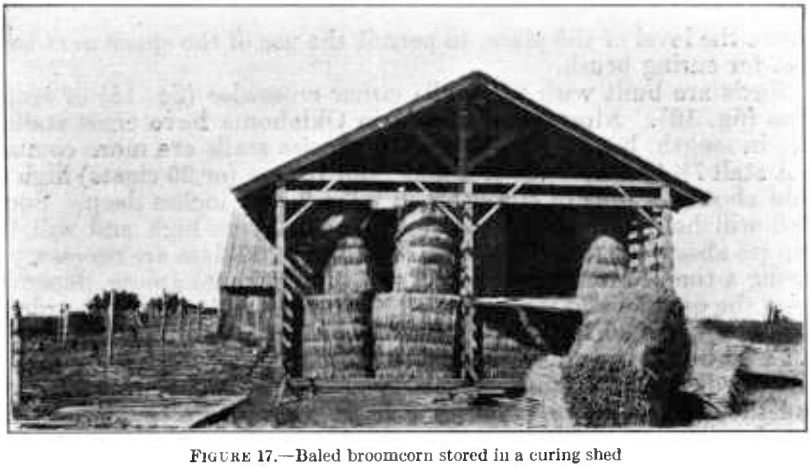

FIGURE 17.—Baled broomcorn stored in a curing shed

and baled hay, and in Illinois most of the better constructed sheds are used also as corncribs.

Bulking of broomcorn brush before baling is practiced to a considerable extent in Illinois, more than half of the growers bulking all or part of their crop. Bulking consists in removing the brush from the slats and piling it in the shed at a depth of 4 to 6 feet. Bulking is done for three reasons: (1) To make shed room available for another cutting of brush; (2) to lessen the drying or shrinkage of the brush before baling; and (3) to reduce the size of crew necessary at baling time. One man can bulk about 2 tons of brush per day. When the bulking is done by the farmer or members of his family, some saving in the expense for hired labor at baling time is effected. If the bulking is done by hired labor, however, the expense is greater than when baling is done directly from the slats, because the total labor is greater when the brush is bulked. About three or four more men are required when baling is done from the slats than when it is done from a bulked

FIGURE 18.—Ricks of broomcorn

pile. These additional men are needed for gathering and carrying the brush from the more or less inaccessible slats and for removing and piling up the slats. If a baler can be secured promptly the brush can be baled as soon as it is dry enough, and further shrinkage thus can be avoided without bulking. Prompt baling permits the use of the shed for a second cutting of brush just as effectively as does bulking, but the latter can be done a few days sooner than baling without the danger of spoiled brush.

The curing of brush in ricks saves considerable labor and expense, but involves a much greater risk from weather. (Fig. 18.) Rick curing is not considered safe except in the semiarid western district Even in that district, shed curing pays during many seasons. Rick-cured brush is seldom of as high quality as shed-cured brush, because of the greater bleaching and sometimes the discoloration from rain. Under favorable weather conditions, however, rick-cured brush may be of excellent color and appearance, especially if the crop is ricked rather promptly after cutting and the ricks are well built.

The ricks usually are 3 to 5 feet high, about 4 feet wide at the bottom and tapering upward, and are made of any convenient length. The brush is laid in two tiers with the seed ends outward and the butts overlapping in the middle of the rick. The seed ends are on the outside at the ends of the rick also. Well-made ricks should be built up by keeping the middle full of brush laid lengthwise and by careful topping to make them shed water. The top is formed with a single layer of brush. Stalks, straw, or poles laid on the ground will protect the bottom layer of brush. Ricks are usually built in or at the edge of the field on which the broomcorn was grown, but occasionally are built in the barnyard. Two men with a team can haul and rick about 1½ tons of brush per day. The brush is loaded on racks just as in hauling green brush to the shed, but dump racks are not used. The brush is taken from the racks in armfuls and placed in ricks. Slightly more labor is required for hauling and ricking brush than for simply hauling and dumping on the ground.

FIGURE 19.—Placing the brush in the baler

BALING

Brush is baled either from the shed or from the rick. When baled from the slats in a shed a crew of about 8 to 15 men is employed. When baling bulked brush about 6 to 10 men are sufficient. A crew of 12 men will bale an average of about 10 tons of brush per day from the slats, and 8 or 9 men will bale about the same quantity from a bulked pile. Two horses are needed with the baling outfit to pull the machine from farm to farm, and one of the horses is used to compress the bales.

In baling broomcorn a man stands in the hopper of the baler and receives the armfuls of brush handed to him by other men and places these armfuls in the hopper with the stems outward, butting them as evenly as possible against the ends of the hopper and spreading out the brush. (Fig. 19.) The armfuls of brush are placed at alternate ends of the hopper with the tips of the brush overlapping in the middle. When the hopper is partly full the front gate is closed and the filling continued until the brush reaches the top of the hopper. Then the lid is clamped down, and the brush is pressed into the size of a bale. A horse attached to a sweep pulls a capstan, and a set of levers forces the plunger up from the bottom. (Fig. 20.) The

sweep moves only in a semicircle and is hooked while the front gate of the hopper is opened and the bale tied with five wires. After tying, the sweep is unhooked and let back, and the bale is rolled out and away from the baler.

The wires are tightened by means of a T-shaped device made from about 1¼-inch iron pipe. Holes are drilled near the end of the long part of the T, and the end of a wire is inserted in one of these holes after it has been drawn through the loop in the other end of the wire. This device is then turned to wind the wire on the pipe and draw the wire through the loop. When tight the wire is bent sharply through the loop to hold the slack, and the pipe is unwound, and the wires are then twisted around themselves and the slack ends used as crossties. The wire used is No. 9, 10, or 11. It comes in bunches of 125 wires each, weighing about 50 pounds and costing $2.50 to $3 a bunch. A

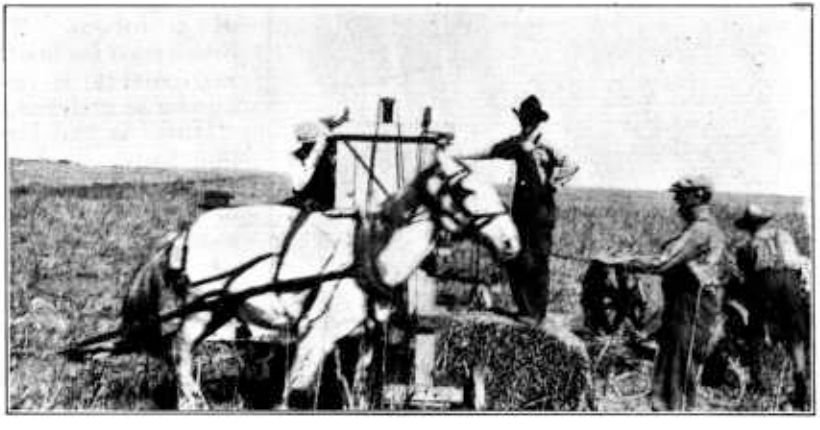

FIGURE 20.—Pressing a bale of broomcorn

bunch is sufficient for 25 bales of broomcorn. Each wire has a loop at one end.

Considerable care is necessary in order to secure uniform and compact bales of brush. A well-made bale of broomcorn is shown in Figure 21. Ragged or uneven bales are unattractive and usually do not bring the best price. Tangled brush can be easily seen in the bale. The bunches of brush must be butted carefully on a flat surface, such as a table, box, or barrel, before they are handed to the man in the baler, and this man also must use considerable care in laying down the brush. Brush with the seed end outward detracts considerably from the appearance of the bale. A bale of brush usually weighs about 300 to 350 pounds, and the extreme variation is from about 200 to 400 pounds or more in weight. Ordinarily about six bales of brush make a ton. The dimensions of the bales are about 26 by 32 by 45 inches.

Where baling is done at the same time as threshing, two balers are sometimes used with one thresher. Brush then can be placed in one baler while the bale is being tied in another. This permits a continuous baling process, whereas with only one baler the bunches of threshed brush must be placed on the ground while a bale is being tied and then picked up again and put into the baler.

An ordinary baler mounted on transport trucks costs about $250 when new. The iron castings occasionally are broken and must be replaced, and the woodwork requires renewing every few years.

Although most of the baling is done by horsepower, machines are available in which the compressing is done by hand with a crank or lever.

MARKETING

MARKET TYPES OF BRUSH

Broomcorn brush is classified roughly according to the use to which it is to be put. That known as "insides" or "handle corn" is usually short and sometimes rather stemmy and is used for making the inside portion of a broom. Brush called "covers" or "turnovers" usually is somewhat longer and is used for making the shoulders of a broom. The brush used for insides and covers is also known as underwork. "Hurl" is the long, fine brush used for making the outside of a broom. "Self-working" brush is any lot which contains approximately the proportion of insides, covers, and hurl desired for making brooms.

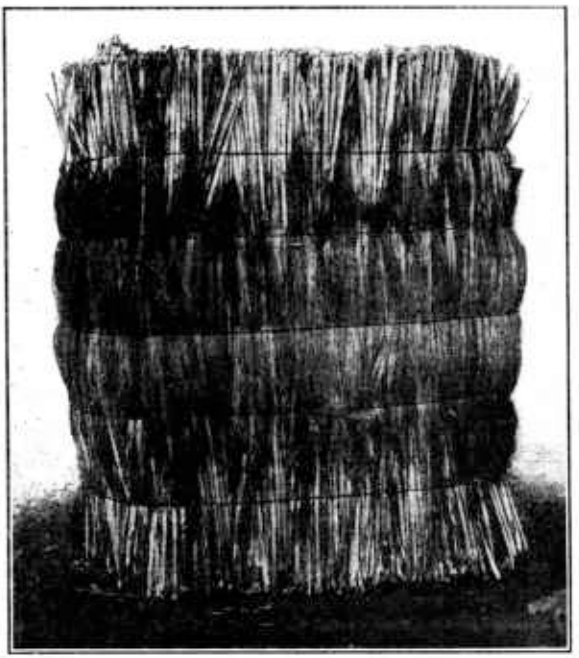

FIGURE 21.—A well-made bale of broomcorn

Various types and grades of brooms are made from the different qualities of brush. The best are known as parlor brooms and are made from good, fine brush having plenty of fine round branches or seed fibers. Other carpet or floor brooms may be made of somewhat coarser brush. Barn brooms and warehouse brooms are made from long, coarse brush which sometimes also is flat or twisted. The coarse brush sells for much less than the finer brush used in making carpet or floor brooms. Whisk brooms are made from the short, fine fibers of the whisk dwarf broomcorn and also from the standard and western dwarf broomcorn brush.

FACTORS DETERMINING QUALITY OF BRUSH

COLOR

The best quality of brush has a bright pea-green color and is free from any discoloration. Brush that is overripe, red, or bleached or whitened from extreme heat before harvesting or from overexposure to the sun does not bring the best price. Much of the brush, especially of the dwarf varieties, contains varying proportions of reddened

fibers. This reddening is due to a coloring material in the broomcorn plants formed whenever the stems, leaves, or heads are injured by insects, mechanical abrasions, excessive moisture, or overmaturity. Broomcorn brush is usually dyed to a uniform green color and bleached with sulphur at the factory just before being made into brooms. The dyeing and bleaching, however, do not eliminate the red color, so red brush is used only in cheap brooms and does not command a high price on the market. Ripe reddened brush is worth about half as much as the same brush harvested at the proper time. Brush sometimes is stained or discolored by mold, exposure to rains, or contact with the ground, or by being "burned" in the shed, rick, or bale. These discolorations affect the market value of the brush, although they can be removed largely by bleaching and dyeing.

FIBER

Other things being equal, brush of medium length brings a higher price than extremely long or short brush unless there is a shortage of the extreme lengths. Brush shorter than 17 inches usually is used for underwork, while that longer than 24 inches either must be used for making up the large barn and warehouse brooms or else must be trimmed and the extra length wasted. Whisk dwarf fiber, however, usually is only 12 to 15 inches long.

The fibers should not be too thick or coarse, as those which are thicker than is desired in a parlor broom bring a lower price because they must be made into cheaper brooms. Fine fibers are one-sixteenth of an inch or less in diameter. Brooms made from coarse fibers do not sweep so cleanly as those from fine ones. Fine branches near the tip of the brush increase the ability of a broom to sweep clean. It is desirable that these branches be near the tip of the brush to be of the most service in sweeping. Good fibers are nearly round, straight, and flexible. All of the fibers should be attached to the stem at approximately the same point, forming a well-defined knuckle.

SEEDING AND BALING

The more thoroughly the brush is threshed the higher the price it will bring. Seed left on the brush is of no value and must be removed at the factory before the broom is completed. The lower price for poorly seeded brush will much more than offset any increased weight due to seed in the brush sold. Well-baled broomcorn brings a higher price than that which is baled in a careless manner and which is likely to go to pieces in handling and shipping. Some growers trim the ends of the stems on the bales to improve the appearance of the bales and to reduce the quantity of stem.

LENGTH OF STEM

The stems of standard broomcorn should be cut to a uniform length of not more than 6 inches to facilitate threshing. The stems are cut off when the brooms are made, except from the part used for insides, and therefore are of no value to the manufacturer.

DEFECTIVE BRUSH

Defective brush consists chiefly of spikes, crooks, and burly, twisted, flat, and stemmy brush. Other defects include bleached, reddened, stained, moldy, burned, wavy, kinky, jointed, and immature brush.

Some of these defects are shown in Figure 22 in comparison with good brush. Brush with serious defects, including crooks, spikes, and badly bleached, reddened, twisted, or curled fibers, should not be harvested

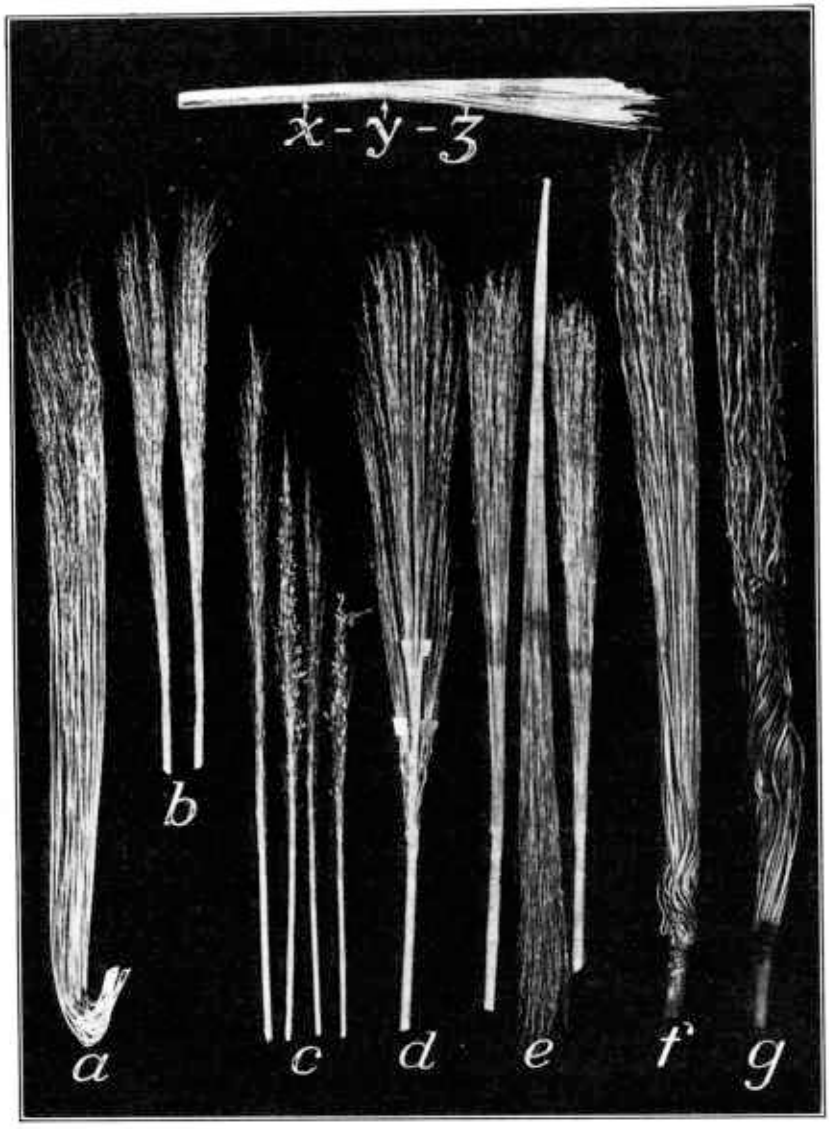

FIGURE 22.—Good and poor heads of dwarf and standard broomcorn: *a*, A good grade of crooked; *b*, high-grade whisk stock; *c*, group of spikes, worthless, but often harvested; *d*, poorly tipped brush showing also a heavy undesirable center stem; *e*, high grades of standard and dwarf, round straight fiber, full tipped with smooth, well-defined knuckles, no center stems; *f*, objectionable curly growth but marketable; *g*, worthless curly brush; *x-y-z*, sectional view of brush showing (*x*) stem, (*y*) knuckle, (*z*) fiber

unless the price is sufficiently high to pay for harvesting and sorting the defective material. When the price of good brush is $250 or more per ton it may pay to harvest the crooks and some of the other seri-

ously defective brush, but all such poor brush should be sorted and baled separately from the better brush.

Spikes, known also as "tree tops," are short heads with the branches coming out all along the main stem, resembling a head of sorghum, and are practically valueless because they do not contain well-defined fibers.

Spikes are produced when the stand is too thick, or the moisture supply insufficient, or when a severe drought occurs while the brush is developing. Spikes also occur in broomcorn that has become crossed with other sorghums, indicating that good seed is important. The branch heads produced on a stalk after the brush has been harvested are always spikes.

Crooks are heads that come out of the boot too rapidly and bend over before the brush has stiffened. After the fiber becomes stiff the crooks can not be straightened. Crooks are chiefly the result of too thin spacing or too much moisture at the time the crop is heading. Tall, rank varieties of broomcorn produce more crooks than the shorter and the dwarf varieties. In order to utilize crooks, the brush must be cut off above the crook and therefore is worth only the value of the portion above the crook. At the low prices of 1928, crooks were not worth harvesting.

Burly, curled, and twisted brush is of some value for insides if this curling or twisting is not too extensive. If the curls, twists, or kinks extend throughout the length of the brush, these defective types should not be harvested. Flat brush is the result of using a poor strain of seed, or of the brush growing too rank, because of thin spacing or excessive moisture. Flat brush is suitable only for large, cheap brooms.

Brush frequently contains center stems one-tenth of an inch or more in thickness. Brush with center stems can be used as insides in a broom but not for hurl, and consequently it brings a lower price than brush without this defect.

The Bureau of Agricultural Economics of the United States Department of Agriculture has established standards for the grading of broomcorn, and some brush is now being marketed on the basis of the United States grades. These standards specify the quantities of brush having various lengths, thicknesses, and defects which may be permitted in each grade of hurl or underwork. Crooks and short spikes are not listed as defects in the standards, but the length of brush in crooks is measured only from the bend to the tip, and short spikes are included in dockage.

MARKETS

Broomcorn brush is sold principally to factory representatives or to other buyers in primary or country markets or is shipped to terminal markets. Local factories are of importance to the grower only in sections where broomcorn is produced very sparingly. As a rule local factories furnish an outlet for only a limited quantity of brush. Most of the broomcorn brush is marketed at important shipping points, including Charleston, Mattoon, and Arcola, Ill.; Lindsay, Pauls Valley, Purcell, Chickasha, and Elk City, Okla.; Liberal, Hugoton, Syracuse, and Elkhart, Kans.; Springfield, Colo.; Portales, N. Mex.; and Beeville, Tex. Warehouse facilities are available at most of these markets, but at some western markets the bales of broomcorn are left on the ground in the open until shipped. (Fig. 23.) Broomcorn frequently is hauled considerable distances by autotruck in order to be sold at

the more important markets. The chief terminal market is Wichita, Kans. Considerable quantities of broomcorn purchased at country markets are shipped to the terminal markets and stored in warehouses while awaiting orders from broom factories. These factories are located in all parts of the United States, but most of the brooms are manufactured near the large centers of population. Shipping broomcorn brush for long distances in carload lots is cheaper than shipping the brooms in small quantities.

TIME AND METHOD OF MARKETING

Much of the broomcorn is sold as soon as it is baled, and sometimes before baling. Growers hold their crop only when higher prices are anticipated or when there is difficulty in securing a buyer. Unless forced to sell in order to obtain money, the growers usually await the pleasure of the buyer in coming out and looking at the brush, believing that overanxiety to sell may result in a lower price. When prices

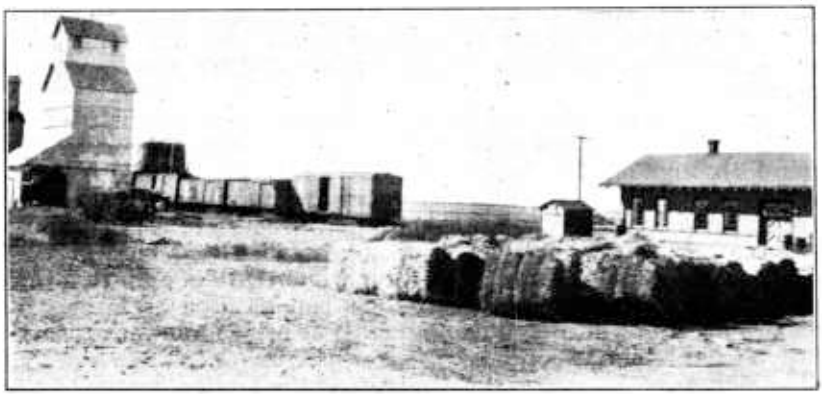

FIGURE 23.—Bales of broomcorn left on the ground in the open, awaiting shipment

seem too low, growers sometimes hold their brush for a year or more before selling, and when the supply of brush is large it must be held or else sold at a low price.

Where brush is rick cured and baled in the open, it should be sold or stored rather promptly, as rains may cause considerable damage to the baled brush. Where the brush is shed cured the bales can be stored in the shed until time for delivery.

The buyers of broomcorn brush usually can be listed under one of the following headings: Local buyer, commission dealer or broker, factory buyer, speculator, or cooperative-marketing association. Local buyers purchase much of the brush that is offered outside of the regular marketing season. These local buyers may be regular broomcorn buyers or may be engaged primarily in some other line of business. Much of the brush is now sold to commission dealers or brokers. These buyers purchase broomcorn on orders from factories and charge their clients a commission. Many brokers maintain warehouses or have storage space available. The brokers usually purchase only brush for which there are orders or a demand.

Large broom factories frequently send out their own buyers during the harvest season and purchase direct from the growers. Factory

buyers visit the same localities as others but are interested only in brush suitable for the types of brooms made by their factory.

Speculators sometimes purchase considerable quantities of brush with the intention of selling it later, frequently at a considerable advance in price. They buy any type of brush on which they think they can make a profit.

Some brush has been marketed through cooperative associations during recent years, but not all of these associations have been successful. Pooling of the crop would be very desirable from the standpoint of the grower if production could be controlled, were it not for the fact that the entire brush requirements could easily be grown by men who are not members of the pool. The comparatively small acreage of broomcorn needed and the large areas in which broomcorn is adapted are effective bars against a monopoly of the crop by the growers in a few sections.

Most of the broomcorn is now sold to buyers who come to the farm. The buyers are able to inspect all of the brush and avoid later misunderstanding in regard to its quality. Buyers usually congregate in a community when the brush is ready for market and buy as much of the crop as can be secured at a satisfactory price. Usually the brush is delivered as soon as it is sold. Many growers exchange work with their neighbors in order to get the crop hauled promptly.

Formerly much of the broomcorn was sold on the street at the marketing points, but at the present time this manner of selling is chiefly confined to growers who have only a few bales to sell. Selling on the street frequently was very unsatisfactory to the growers, because they believed that the buyers took advantage of the fact that a farmer would sell at almost any price rather than haul his brush back to the farm. Frequently when the demands were well supplied it was impossible for a farmer to sell his load of brush on the street until the close of the day and then only at the buyer's price. Strong competitive bidding for brush is likely only when there is a shortage of brush.

The marketing of broomcorn is on a very unsatisfactory basis. There are no definite price quotations such as are reported in the daily papers for most other agricultural commodities. Approximate prices of brush reported by dealers are available in broomcorn trade journals and some local newspapers. These prices are not based on definite grades or qualities of brush, however. Purchases and sales of brush at the country points are made by oral bargaining, which usually consists of a battle of wits.

When the needs of buyers are supplied they are not interested in further purchases except for speculation, because they are not able to dispose of unlimited quantities at terminal markets, as they can some farm commodities.

Most of the brush except that produced on farms within 5 miles of town is now hauled from the farm to the market by autotrucks. (Fig. 24.) From 9 to 12 bales usually make a load for a small or mid-sized truck. Farmers without trucks usually hire their crop hauled unless they are near enough to market to haul two loads a day with a team. The charges for hauling broomcorn vary from $1.50 a ton for short distances up to $4 a ton where the haul is 20 to 25 miles. Only six or eight bales can be loaded on an ordinary wagon rack, so that hauling long distances with teams is not economical.

Farmers growing small quantities of broomcorn sometimes manufacture brooms for sale instead of selling the brush. The brooms can be made during spare time in the winter. Equipment for broom making by hand can be secured at a moderate cost, but the more efficient power winding and stitching machines are rather expensive. The economy of making brooms instead of selling brush depends upon the skill of the farmer in making and selling the brooms. Only a small proportion of the broomcorn crop is made into brooms on the farm. About 80 to 100 dozen of ordinary brooms can be made from a ton of brush.

DISPOSAL OF SEED AND STALKS

Where broomcorn brush is harvested promptly and threshed before curing, the seed is so immature and wet as to be practically valueless. It is usually allowed to rot in the pile and later hauled out as manure. In the western district, where the crop is threshed after curing, the seed has some feed value. Seed from brush harvested at the proper time is chaffy and of little value, but the more nearly mature the seed is when harvested the better it is for feed. Mature broomcorn seed has about the same value as oats for feed. Considerable quantities of broomcorn seed are fed to chickens and frequently to other kinds of livestock. As a rule, however, the livestock are simply allowed to run to the seed pile and eat as much as they want. A few growers reclean the seed and save the heavier portion for feed. Estimates of growers show that they consider broomcorn seed worth from nothing to about as much as corn and grain sorghums.

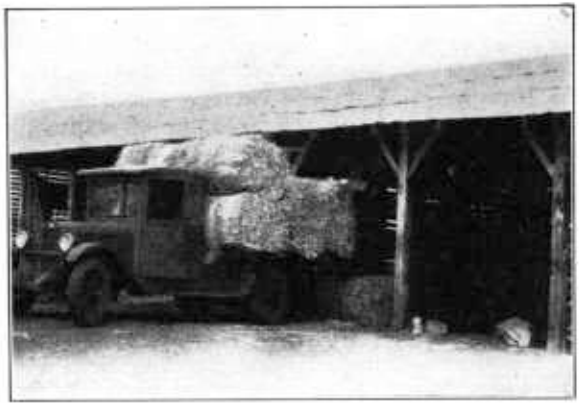

FIGURE 24.—Loading broomcorn on a truck for hauling to market

The stalks of standard broomcorn seldom are used except as crop residues which are returned to the soil. Dwarf broomcorn stalks, on the other hand, are regarded of considerable value for pasture where livestock is available. Some farmers who are able to turn in their stock or rent their dwarf broomcorn-stalk pasture consider it worth about $1 to $2 an acre, but often there are too few animals to utilize the available feed. The dwarf broomcorn stalks remain green after the brush is removed because the stalks are not broken over during the harvesting operation as in standard broomcorn. Dwarf broomcorn stalks are more leafy than those of standard varieties, and the plants produce more suckers. The western dwarf type of broomcorn also produces more fodder than the early standard sorts in the western district.

Many broomcorn growers in Illinois and in the Lindsay district of Oklahoma burn the broomcorn stalks before plowing the land. If the stalks are thoroughly dry they can be easily burned by setting

fire to the tables. In this way one man is able to burn about 20 acres or more of stalks per day. If the stalks must be cut and raked before burning, about three days' additional labor with a man and team will be required on 20 acres. Many of the growers are able to plow under the stalks directly usually by using a tractor-drawn 18-inch sulky plow. Plowing with this outfit is more tedious than plowing ordinary stubble land with a 2-bottom plow, but in this way a considerable quantity of organic matter can be put into the soil. Stalk cutters or rails, such as are used on cornstalks, sometimes are used to break the broomcorn stalks in the spring.

In recent years a small quantity of broomcorn stalks has been used in the manufacture of paper and other cellulose products, but industrial uses for broomcorn stalks are yet in their infancy.

COSTS AND RETURNS

Broomcorn when produced on an extensive scale requires more capital than many other field crops. Some special equipment is necessary, and intensive methods, involving a relatively large cash outlay for labor to perform the handwork, are essential to the successful production of this crop.

The principal items entering into the cost of broomcorn production are man labor, horse and tractor work, seed, threshing and baling, use of equipment, and use of land.

In the standard broomcorn district of east-central Illinois, based on the usual field practice, with a yield of 600 pounds of brush per acre, farmers produce an acre of broomcorn with about 42 hours of man labor, 17½ hours of horse work, and 2½ hours of tractor work. These requirements amount to 140 hours of man labor, 59 hours of horse work, and 8 hours of tractor work per ton and are for farms where tractors are used for plowing and disking. In the Lindsay district of south-central Oklahoma, where the yield is slightly less than in Illinois and where it is not the usual practice to use tractor power, the man labor per acre amounts to about 43 hours and the horse work to about 37 hours for a yield of 500 pounds per acre. On a ton basis it takes about 172 hours of man labor and 151 hours of horse work. These yields are higher than the average for each State, but are representative of average yields obtained on the better soils of the broomcorn area.

In the western or dwarf broomcorn district, represented by southwestern Kansas, where it is not the general custom to shed cure the brush and where less tillage and cultivation are required, these requirements are somewhat less than in the more intensive standard broomcorn sections. For a yield of 333 pounds per acre, about 24 hours of man labor and 17 hours of horse work per acre are required. These requirements amount to 145 hours of man labor and about 104 hours of horse work per ton.

Much of the work comes at harvest time, when extra man labor must be hired. In 1928 harvest wages ranged from 20 to 35 cents per hour with board. Field bosses were paid 35 to 50 cents per hour and occasionally $1 per acre.

In recent years good seed has cost from $2 to $10 per bushel or from 10 to 70 cents per acre for a single planting. The charge for custom threshing ranges in the different areas from $4 to $6 per ton and for custom baling from $1 to $1.50 per ton where the grower furnishes the crew. In southwestern Kansas seeding and baling combined cost

$5 to $6 per ton where the grower furnishes the crew. Growers who own threshers and balers may save some of this expense. Baling wire costs from 60 to 70 cents per ton of brush.

Other costs, including taxes, fire insurance on the brush, use of machinery, use of broomcorn shed, losses due to abandoned acreage, reseeding, and overhead expenses, amount to about $2 per acre in southwestern Kansas and $7.50 per acre in south-central Oklahoma and east-central Illinois.

In 1928 broomcorn land was valued at $150 per acre in east-central Illinois, $125 in south-central Oklahoma, and $25 in southwestern Kansas. Interest charges are frequently considered a part of production costs, and when figured at 6 per cent of these, land valuations amount to $9 per acre in Illinois, $7.50 in Oklahoma, and $1.50 in Kansas.

Including interest on land, the total 1928 cost to a group of owner operators was $15.50 per acre in southwestern Kansas, $35 in south-central Oklahoma, and $38 in east-central Illinois. The cost per ton amounted to $93 in Kansas, $139 in Oklahoma, and about $125 in Illinois, on the basis of yields of 333, 500, and 600 pounds per acre in the three sections. Excluding the interest charges, the cost per acre amounted to about $14, $27.50, and $29 in these States, respectively.

Tenant farmers in Illinois usually give as rent a third and in Kansas and Oklahoma a fourth of the crop delivered to market. The 1928 cost of a ton of broomcorn brush to tenant operators was about $120 in southwestern Kansas and $128 in south-central Oklahoma and east-central Illinois.

The foregoing costs per ton would be higher with lower yields, higher-priced lands, or if the work were increased by unfavorable weather conditions, and would be less if yields were higher or other conditions more favorable. Costs on individual farms surveyed varied from $75 to $200 per ton. Costs in southwestern Kansas are similar to those in Colorado, New Mexico, and northwestern Oklahoma. In much of western Oklahoma costs are between those in southwestern Kansas and in south-central Oklahoma.

Individual lots of broomcorn brush have sold as low as $40 and as high as $500 per ton since the pre-war period. The average United States farm price on December 1 during the five years from 1925 to 1929 has varied from $78 to $143 per ton. On the farms studied the quality of brush was considerably better than for the country as a whole. In Illinois on these farms the average price received in 1929 was $175, in Oklahoma $120, and in Kansas $115 per ton in comparison with an average United States farm price of $122 on December 1, 1929.

Broomcorn is seldom more profitable than other adapted farm crops except when broomcorn prices are high. The farm price of broomcorn brush varies widely, according to supply and demand and quality of the brush. In each of these areas there is at least one major competing cash crop, and when, in the opinion of the grower, the price of broomcorn brush becomes unattractive there is a tendency to substitute some other cash crop for at least a part of the broomcorn acreage.

Broomcorn should be grown only in established districts where it can be marketed readily, unless there is a local market, since buyers usually visit only established broomcorn districts. It requires considerable knowledge and skill to produce a good quality of brush, and

unless a grower has had this experience in growing and handling the crop he is likely to produce broomcorn of low quality which will not command a good price.

DISEASES

Broomcorn is attacked by the same diseases that attack other sorghums, and the methods of control are the same.

SMUT

Smut is the principal fungous disease attacking broomcorn. The smut usually found is the one known as covered kernel smut (*Sphacelotheca sorghi*). Different physiologic forms of this disease are known, but they all attack broomcorn. This smut destroys the seeds in the heads and produces elongated galls or masses of dusty, nearly black spores where the seeds should have developed. The brush on badly smutted heads does not develop so well as in sound heads. If the brush is slightly damp when threshed the smut spores will be smeared over the brush during the threshing operation, making it dark and unattractive.

All varieties of broomcorn appear to be susceptible to covered kernel smut. The disease can be controlled, however, by seed treatment. The method of treatment formerly used consisted of soaking the seed in a solution of 1 pint of commercial formaldehyde (formalin) to 30 gallons of water. The seed is placed in sacks and immersed in the solution for an hour and then removed, treated, and spread out to dry. The seed can also be treated by sprinkling with the formaldehyde solution and leaving the pile of seed, which has been stirred while sprinkling, covered with a canvas over night, after which the seed is dried.

Dipping the seed in a solution of copper sulphate (bluestone), 1 pound to 5 gallons of water, also controls kernel smut in broomcorn.

Dust treatments are more convenient to use than the liquid formaldehyde treatment. Copper-carbonate dust, which is used for treating seed wheat to prevent smut, also largely controls the covered kernel smut of broomcorn, but this treatment is not quite so effective as the formaldehyde treatment. Recent experiments have shown that Ceresan, a mercury-compound dust, will completely control the covered kernel smut of broomcorn. This dust should be applied at the rate of about 3 ounces per bushel of seed. The dust can be mixed with the seed in any regular dust-treating machine or by shaking the dust and seed together in a tight box, barrel, or can.

Another kind of smut attacking broomcorn is known as loose kernel smut (*Sphacelotheca cruenta*). It differs from the covered kernel smut in having longer and more slender galls which break up more easily. The loose kernel smut is controlled by the same methods as the covered kernel smut.

The head smut (*Sorosporium reilianum*) of sorghums, for which no satisfactory control method is known, seldom attacks broomcorn.

OTHER DISEASES

Sorghum rust (*Puccinia purpurea*) attacks the leaves of broomcorn but is not known to cause any appreciable losses. No control for this disease is known. The leaf-spot diseases of broomcorn that produce reddish stripes or spots on the leaves apparently are not destructive. They are caused by species of bacteria (*Bacterium andropogoni, B. holcicola, B. holci*), but no method of control is known.

INSECT PESTS [3]

Many insect pests common to Indian corn and the grain sorghums also attack broomcorn. Among the more important of these are the corn earworm, common stalk borers, webworms, the army worm, army cutworm, fall army worm, sorghum webworm, green bug, corn-leaf aphid, chinch bug, white grubs, leaf hoppers, and grasshoppers. The control of these pests on broomcorn is, for the most part, similar to the control of such insects on Indian corn and the grain sorghums; however, control measures will differ somewhat because of variation in cultural practices and more particularly the time and method of harvest. Information is usually available on the biology and control of most of these insect pests, and although the damage caused by various species may look the same, the control measures are usually different.

When injury is observed and information desired, specimens of the insects causing the damage, together with a sample of the injured plant, should be sent either to the State experiment station or to the Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

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[3] Prepared by W. H. Larrimer, Bureau of Entomology, U. S. Department of Agriculture.

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August 15, 1930

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